Yields of Asparagus As Affected by Severe Cutting of Young Plantation

By J. W. Lloyd and
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By J. W. Lloyd and J. P. McCollum[1]

ASPARAGUS thrives in practically all parts of Illinois, important producing counties being scattered thruout the state. The counties having the highest asparagus acreage in 1929, the last year for which statistics by counties are available, were Union, Cook, Madison, Pulaski, and Jackson, in the order given (Table 1). Total acreage for the state that year was reported to be 4,664 acres. Since 1929 the acreage harvested has not changed materially,[2] tho within the last two years quite extensive new plantings have been made primarily for canning. Until the last few years most Illinois growers were chiefly interested in producing this crop for the fresh-vegetable market rather than for canning.

Asparagus is a slow-developing crop. A plantation requires at least eight or ten years to reach full production. In the absence of specific experimental information on the effects of cutting a young asparagus plantation many growers, eager of course to begin marketing as soon as possible, start cutting the first year after the roots are planted. Other growers, convinced that the early cutting is harmful to the later development of the plants, wait until the second or even the third year. Late cutting of asparagus any season, even after the plants are mature, shortens the growing period during which plants store up food supplies in their roots for the production of the next year's crop, and it is only to be expected that severe cutting of the plants while they are young would be especially harmful. To clear up this question experiments were started in the spring of 1926 at the Cook county experiment station, where experiments with truck crops are conducted by the University of Illinois. A planting of Mary Washington variety was made. Results of the experiment during the first seven years, previously reported in Illinois Bulletin 401,[3] showed a close relation between the severity of cutting and the total amount of asparagus

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[2]According to correspondence with A. J. Surratt, State Statistician, Springfield, Illinois, March 19, 1938.

[3]Lewis, E. P. Asparagus Yields as Affected by Severity of Cutting. Ill. Agr. Exp. Sta. Bul. 401. 1934. This bulletin is now out of print and is superseded by the present publication.

harvested during the seven years, the most severe cutting being associated with the lowest yields and the smallest average size of shoots.

The present report continues the study and deals particularly with the performance of this plantation during the period from 1931 to 1937, when all plots were cut for eight weeks each season. The plantation was five years old at the beginning of this seven-year period. The

TABLE 1.—ACREAGE OF ASPARAGUS IN ILLINOIS, FIFTEEN COUNTIES AND STATE AS A WHOLE, 1929[a]

County	Number of acres	County	Number of acres
Union	1 011	Ogle	98
Cook	755	Lee	86
Madison	516	Sangamon	81
Pulaski	492	Peoria	73
Jackson	397	Kendall	42
LaSalle	215	St. Clair	35
Kane	175		
Kankakee	128	Other counties	460
Will	100		
		Total	4 664

[a]U. S. Census, 1929.

data presented show how various degrees of severity in cutting during the first four years of the plantation (1927-1930) affected the yield and market quality of the asparagus produced after the plantation was five years old.

PLAN OF THE EXPERIMENT

Roots grown from seed sown in 1925 were used for planting in the spring of 1926. There were 18 plots, each consisting of a single row 375 feet long. The rows were 4 feet apart, and the plants were spaced at intervals of 2½ feet in the row. Thus each plot consisted of $\frac{1}{29}$ acre, planted with 150 crowns.

The area used for this experiment included the following soil types: Saybrook Silt Loam, Lisbon Silt Loam, Lisbon Clay Loam and Silty Clay Loam. The land had been tile-drained and was in a good state of cultivation at the time the experiment was started. All plots were treated alike as to cultivation and fertilizing. At the end of the cutting season, each year after the first year, a 4-8-4 fertilizer was applied to all plots at the rate of 500 pounds per acre.

The only difference in treatment of plots was in severity of cutting during the first four years after the plantation was set. During this period six different degrees of cutting were made in triplicate, as indi-

cated in Table 2. Plots were cut for various lengths of time beginning the first, second, and third years after planting. Beginning in 1931, the fifth year after planting, all plots were cut for eight weeks each year.

Harvesting was done at intervals of one to two days, depending upon the temperature and hence the rapidity of growth of the shoots. The product of each plot was arbitrarily graded into three sizes of shoots, designated as No. 1, No. 2, and culls or "strings." No. 1

TABLE 2.—CUTTING SCHEDULES ON 18 PLOTS DURING FIRST FOUR YEARS OF ASPARAGUS PLANTATION
(Roots planted in spring of 1926)

Treatments[a]	Plots[b]	Number of weeks of cutting			
		1927	1928	1929	1930
1—Cutting begun 3d year, full cutting 5th year.....	1, 7, 13	0	0	4	6
4—Light cutting 2d year, full cutting 4th year.....	4, 10, 16	0	2	4	8
2—Medium cutting 2d year, full cutting 4th year.....	2, 8, 14	0	4	6	8
5—Light cutting 1st year, full cutting 3d year.....	5, 11, 17	2	4	8	8
3—Medium cutting 1st year, full cutting 3d year.....	3, 9, 15	4	6	8	8
6—Heavy cutting 1st year, full cutting 2d year.....	6, 12, 18	6	8	8	8

[a]In all subsequent tables the data given for Treatments 1 to 6 are averages of the three replications indicated here.
[b]Each plot was 1/29 acre in size.

shoots were at least ½ inch in diameter; No. 2 were ¼ to ½ inch,[1] and the culls were under ¼ inch. The diameter was measured at or near the butt, using the greatest thickness of the shoot in cases where the shoots were not exactly circular in cross-section. The weights recorded were the weights of the shoots as cut in the field without trimming.

The various bases for comparing the results of the different treatments were the following: total number of shoots; total weight of shoots; number and weight of marketable shoots; average weight per shoot; and percentage of shoots that were No. 1, No. 2, and culls. Yields, either in number or in weight of shoots, are based on three replications of each treatment on plots 1/29 acre in size.

[1]These sizes and grade designations are not identical with the present official grade specifications for Illinois asparagus, but have been kept uniform thruout the experiment, even tho the official grade specifications have been changed from time to time.

FIRST-YEAR CUTTING REDUCED YIELDS

All plots that were cut the first year (Treatments 5, 3, and 6) produced smaller numbers of shoots and lower total weights of asparagus each of the seven years after full cutting of all plots began, than the plots which were not cut at all until the third year (Treatment 1). Furthermore, the plots that were cut the longest time the

TABLE 3.—TOTAL NUMBER OF ASPARAGUS SHOOTS, ALL SIZES, 1931-1937
(Averages of three replications of each cutting treatment, 1/29 acre)

Treatment No.	1931	1932	1933	1934	1935	1936	1937	Total
1.....	1 508	2 172	2 290	3 198	2 616	3 516	3 477	18 777
4.....	1 510	2 186	2 393	3 292	2 693	3 557	3 560	19 191
2.....	1 314	1 899	2 012	2 887	2 345	3 089	3 086	16 632
5.....	1 371	1 936	2 035	2 787	2 348	3 054	3 084	16 615
3.....	1 146	1 642	1 764	2 421	1 985	2 634	2 640	14 232
6.....	1 027	1 424	1 626	2 330	1 998	2 586	2 679	13 670

TABLE 4.—TOTAL WEIGHTS OF ASPARAGUS SHOOTS, ALL SIZES, 1931-1937
(Averages of three replications of each cutting treatment, 1/29 acre)

Treatment No.	1931	1932	1933	1934	1935	1936	1937	Total
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1.....	97.3	158.5	151.5	229.2	210.0	220.6	215.8	1 282.9
4.....	98.8	170.5	169.4	249.3	228.0	231.3	214.8	1 362.1
2.....	80.5	135.8	134.3	212.8	189.7	195.5	186.5	1 135.1
5.....	73.9	132.3	133.1	211.2	199.0	201.6	202.3	1 153.4
3.....	61.6	108.0	110.8	175.2	160.7	163.9	155.5	935.7
6.....	52.3	92.7	101.0	164.5	156.8	162.5	170.8	900.6

first year (Treatments 3 and 6)[1] produced less than the plots that were cut for a shorter period the first year (Treatment 5).[2] During the seven years after full cutting began, the plots not cut at all until the third year yielded 129.5 pounds more asparagus per plot than the plots cut 2 weeks the first year; 347.2 pounds more than the plots cut 4 weeks the first year; and 382.3 pounds more than the plots cut 6 weeks the first year (Table 4). According to statistical analysis[3] of

[1]Total of 249 and 355 shoots harvested from plots receiving Treatments 3 and 6 respectively.

[2]Total of 91 shoots cut from 150 crowns.

[3]Love, H. H. A modification of Student's table for use in interpreting experimental results. Jour. Amer. Soc. Agron. 16, 68-73, 1924.

the data, all these differences were highly significant, the odds being from 4999:1 to > 9999:1 that the differences were not due to chance.

Thus cutting for 2 weeks the first year proved to be much less harmful than cutting for longer periods; but cutting for 4 weeks was practically as harmful as cutting for 6 weeks. Both in number and in weight of shoots harvested there was very little difference between the plots cut 4 weeks the first year and those cut 6 weeks (Tables 3 and 4, and Fig. 1).

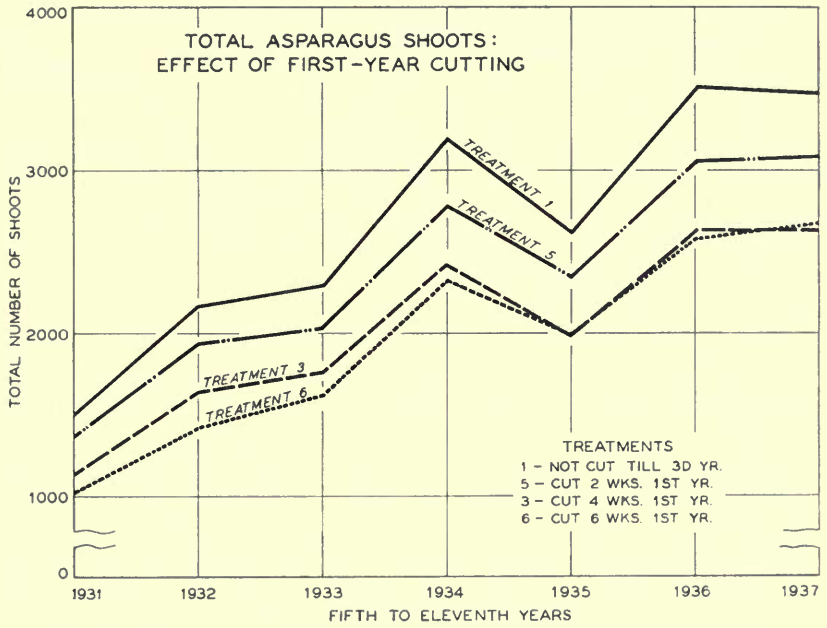

FIG. 1.—EFFECT OF FIRST-YEAR CUTTING OF ASPARAGUS ON NUMBER OF SHOOTS DEVELOPED IN SUBSEQUENT YEARS

After the plantation was five years old, the effects of differences in early cutting were clearly evident each year. All plots that had been cut the first year after planting yielded consistently less than the plots not cut until the third year. The pronounced drop in the 1935 yields was caused by the severe drouth during the summer of 1934.

LIGHT CUTTING SECOND YEAR APPARENTLY BENEFICIAL

Cutting for a period of 2 weeks during the second year after planting appeared to be beneficial. The total yield, both in number and in weight of shoots, from plots which were cut in this manner (Treatment 4) was consistently greater than from plots not cut at

all until the third season (Treatment 1, Fig. 2). During the seven years after full cutting of all plots began, a total of 79.2 pounds more asparagus per plot was cut from the plots cut lightly the second year than from the plots not cut until the third year (Table 4). Altho this difference was small, the odds were 191:1 that it was significant. The same relationship existed between numbers of shoots produced, 414 more per plot being cut from the plots that were cut lightly the second year than from the plots not cut until the third year (Table 3).

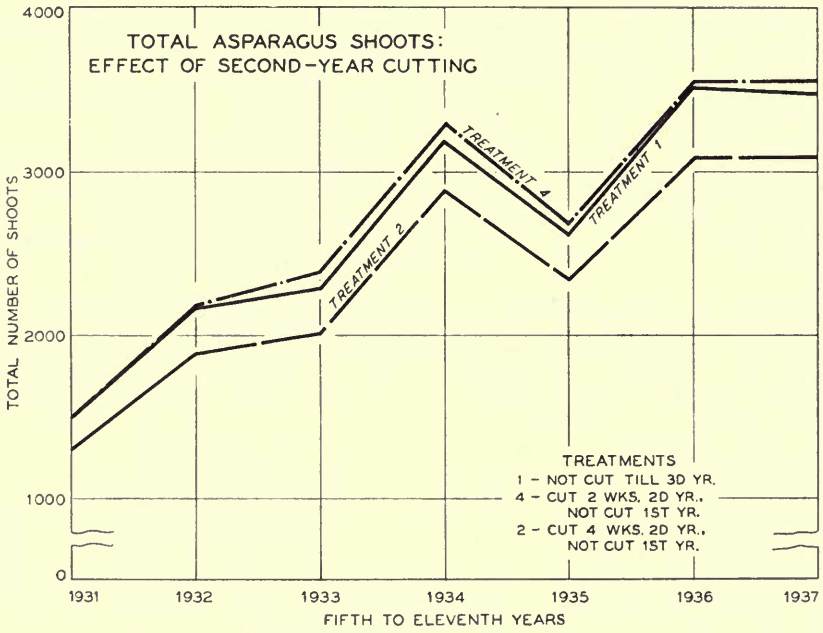

FIG. 2.—EFFECT OF SECOND-YEAR CUTTING OF ASPARAGUS ON NUMBER OF SHOOTS DEVELOPED IN SUBSEQUENT YEARS

Cutting for 2 weeks the second year of the plantation did not prove harmful to subsequent yields, even appeared to have a beneficial effect. But cutting for 4 weeks resulted in definitely lower yields than were obtained from plots cut a shorter time or not cut at all until the third year.

On the other hand, cutting for 4 weeks the second season (Treatment 2) resulted in definitely lower yields than those obtained from plots not cut until the third year. During the seven years after full cutting began, the plots not cut until the third year yielded 147.8 pounds more asparagus per plot than those cut 4 weeks the second year (Table 4). The odds were $>$ 9999:1 that this difference was significant.

DIFFERENCES IN YIELDS OF MARKETABLE SHOOTS

Since the yield of marketable shoots[1] is more important than the total yield of all shoots, the different plots are compared on that basis also. In general the relationships between the plots when compared on this basis were similar to those when they were compared on the basis of total number of shoots cut, including culls.

TABLE 5.—YIELDS OF MARKETABLE ASPARAGUS: TOTAL NUMBER OF GRADE NO. 1 AND GRADE NO. 2 SHOOTS, 1931-1937
(Averages of three replications of each cutting treatment, 1/29 acre)

Treatment No.	1931	1932	1933	1934	1935	1936	1937	Total
1.....	1 252	2 010	1 867	2 660	2 356	3 056	2 895	16 096
4.....	1 271	2 073	2 051	2 864	2 455	3 144	2 962	16 820
2.....	1 073	1 772	1 659	2 450	2 099	2 678	2 566	14 297
5.....	1 058	1 771	1 655	2 401	2 136	2 686	2 651	14 358
3.....	868	1 489	1 405	2 037	1 754	2 276	2 172	12 001
6.....	772	1 333	1 331	2 015	1 813	2 287	2 309	11 860

Plots Cut Most Severely While Young Lagged Farthest Behind.—The yields from the plots cut for 4 and 6 weeks respectively the first year (Treatments 3 and 6) were distinctly inferior each year to those from plots cut for only 2 weeks the first year (Treatment 5). Even the latter plots, however, showed the unfavorable effect of first-year cutting, for they yielded distinctly less each of the seven years than plots which were not cut at all until the third year after setting (Treatment 1, Fig. 3). These differences were evident whether the comparisons were on the basis of number or of weight of marketable shoots (Tables 5 and 6). The total yield of marketable asparagus from the plots cut 6 weeks the first year was 246.3 pounds per plot less than that from the plots cut 2 weeks the first year, and 367.2 pounds less than that from the plots not cut until the third year.

Favorable Effects From Light Second-Year Cutting.—A greater number and greater total weight of marketable shoots were cut from plots cut 2 weeks the second year (Treatment 4) than from plots not cut at all until the third year (Fig. 4). While the differences were not very great any year and the yields by weight were practically identical one year of the seven, there was a difference for the seven-year period of 83.9 pounds per plot in favor of the plots cut lightly the second year (Table 6). That this difference was significant is shown by a

[1]All shoots more than 1/4 inch in diameter.

TABLE 6.—YIELDS OF MARKETABLE ASPARAGUS: TOTAL WEIGHT OF GRADE No. 1 AND GRADE No. 2 SHOOTS, 1931-1937

(Averages of three replications of each cutting treatment, 1/29 acre)

Treatment No.	1931	1932	1933	1934	1935	1936	1937	Total
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1.....	92.6	156.9	144.1	219.0	204.6	213.1	203.7	1 234.0
4.....	94.4	169.2	163.4	240.7	223.0	224.5	202.7	1 317.9
2.....	76.2	134.5	128.1	204.2	184.7	189.6	176.6	1 093.9
5.....	68.3	130.6	126.4	203.4	194.7	196.2	193.5	1 113.1
3.....	56.5	106.4	104.5	167.5	156.3	158.4	146.8	896.4
6.....	47.6	91.8	95.8	157.7	153.2	157.2	163.5	866.8

statistical analysis of the data, indicating odds of 191:1. It is probable that light cutting the second year stimulated a branching of the crowns which was favorable to greater production.

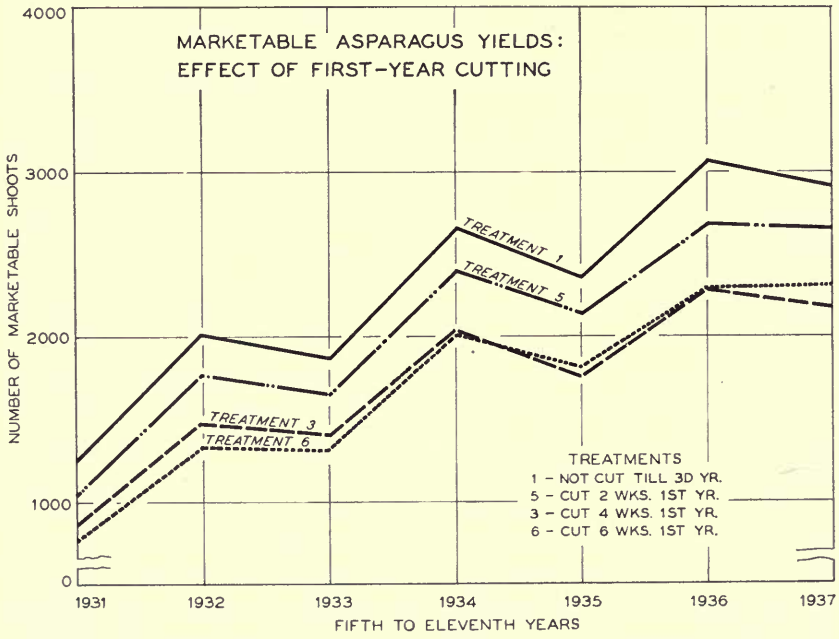

FIG. 3.—EFFECT OF FIRST-YEAR CUTTING OF ASPARAGUS ON NUMBER OF MARKETABLE SHOOTS DEVELOPED IN SUBSEQUENT YEARS

Considerably smaller numbers of marketable shoots were produced by the plots which were cut for 4 to 6 weeks during the first year, than were produced by the plots not cut at all until the third year. Cutting for 2 weeks the first year also reduced the yields, but not so much as the heavier cutting.

While light second-year cutting resulted in some improvement in yields, cutting for 4 weeks during the second season (Treatment 2) resulted in much lower yields of marketable shoots each of the seven years than were obtained either from plots which were lightly cut (Treatment 4) or from plots which were not cut until the third year (Treatment 1). Total yields for the seven-year period from plots cut 4 weeks the second year were 224 pounds per plot less than from the

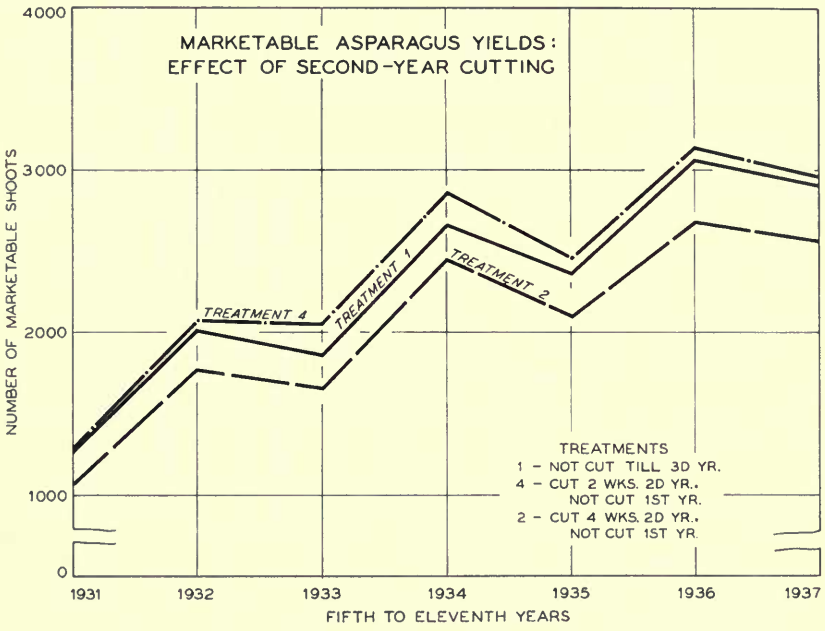

FIG. 4.—EFFECT OF SECOND-YEAR CUTTING OF ASPARAGUS ON NUMBER OF MARKETABLE SHOOTS DEVELOPED IN SUBSEQUENT YEARS

More marketable shoots were produced each year by the plots cut for 2 weeks the second year after planting than by the plots not cut until the third year. Cutting for 4 weeks the second year proved detrimental to later yields.

plots cut only 2 weeks, and 140.1 pound less than those from the plots not cut until the third year (Table 6). Again the differences were significant, the odds being $>$ 9999:1 in each case.

SEVERE CUTTING REDUCED SIZE OF SHOOTS

The average weight of the individual shoots from each plot was calculated by dividing the total weight of shoots produced on that plot each year by the total number of shoots produced that year. The weights, expressed in decimal fractions of a pound, are shown in

TABLE 7.—AVERAGE WEIGHT OF INDIVIDUAL ASPARAGUS SHOOTS PRODUCED ON PLOTS RECEIVING DIFFERENT CUTTING TREATMENTS, 1931-1937
(Averages of three replications of each cutting treatment, 1/29 acre)

Treatment No.	1931	1932	1933	1934	1935	1936	1937	Seven-year average
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1	.064	.073	.066	.072	.080	.064	.062	.069
4	.065	.078	.071	.075	.085	.065	.060	.071
2	.061	.071	.067	.074	.081	.063	.060	.068
5	.054	.069	.065	.076	.085	.066	.066	.069
3	.053	.066	.063	.072	.084	.062	.063	.066
6	.051	.065	.062	.071	.078	.063	.067	.065

Table 7. As a seven-year average, the largest shoots were produced on plots which were cut lightly the second year (Treatment 4). The shoots averaging smallest were from the plots cut most severely during the early life of the plantation. There was a tendency for the shoots from plots which were cut lightly the first year (Treatment 5) to improve in relative size during the last four years.

The weights of the No. 1 shoots and of the No. 2 shoots from each plot each year are given in Table 8. The total yields, on the weight basis, of No. 1's, No. 2's, and culls for the entire seven-year period are shown in Fig. 5.

TABLE 8.—WEIGHT OF GRADE NO. 1 AND OF GRADE NO. 2 ASPARAGUS FROM DIFFERENTLY TREATED PLOTS, 1931-1937
(Averages of three replications of each cutting treatment, 1/29 acre)

Treatment No.	1931	1932	1933	1934	1935	1936	1937	Total
				Grade No. 1				
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1	67.1	118.8	96.6	136.7	132.8	154.4	151.4	857.8
4	68.6	131.4	114.0	152.4	151.3	167.4	154.3	939.4
2	54.2	101.2	86.2	129.3	122.8	145.2	137.0	775.9
5	45.6	95.8	84.6	130.1	134.1	150.7	154.3	795.2
3	37.1	75.3	69.0	105.3	107.2	115.8	111.3	621.0
6	29.2	63.7	59.5	95.0	97.4	117.4	129.8	592.0
				Grade No. 2				
1	25.5	38.1	47.5	82.3	71.9	58.7	52.3	376.3
4	25.8	37.8	49.4	88.3	71.7	57.2	48.3	378.5
2	22.0	33.3	41.9	74.8	61.9	44.4	39.6	317.9
5	22.7	34.8	41.8	73.3	60.6	45.5	39.2	287.9
3	19.4	31.1	35.5	62.1	49.1	42.7	35.5	275.4
6	18.4	28.1	36.3	62.7	55.8	39.8	33.7	274.8

The percentages of No. 1 shoots from each plot each year are given in Table 9, on the bases of both number and weight. From both standpoints, the plots cut lightly the second year (Treatment 4) were superior to all others during each of the early years of the seven-year period and also as an average for the entire seven years. During the latter part of the seven-year period, however, there was marked

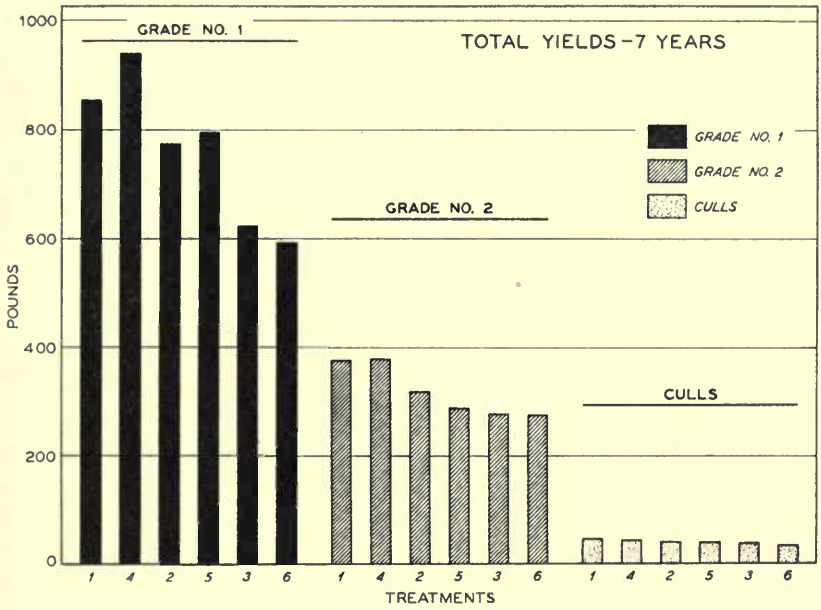

FIG. 5.—TOTAL YIELDS OF DIFFERENT GRADES OF ASPARAGUS DURING SEVEN-YEAR PERIOD 1931-1937, AFTER DIFFERENT CUTTING TREATMENTS

Superior to all other cutting treatments, especially in the production of Grade 1 asparagus, was Treatment 4, which included cutting the plantation for 2 weeks during the second year after the roots were set and for 4 weeks the third year.

improvement in the relative position of plots which were lightly cut the first year (Treatment 5). Also during the last two years of the test, there was some improvement in the relative position of plots which were heavily cut the first year (Treatment 6).

TOTAL YIELDS DURING LIFE OF PLANTATION

In total yield of asparagus of all grades (No. 1, No. 2, and culls) during the eleven-year period from the time the first cuttings were made on the one-year-old plantation until the close of the experiment, when the plantation was twelve years old, all plots that were cut at all

TABLE 9.—PERCENTAGES OF GRADE NO. 1 ASPARAGUS SHOOTS FROM DIFFERENTLY TREATED PLOTS, 1931-1937

(Averages of three replications of each cutting treatment, 1/29 acre)

Treatment No.	1931	1932	1933	1934	1935	1936	1937	Seven-year average
				On basis of number				
1	48.1	52.6	39.9	36.8	42.4	46.9	49.3	45.1
4	49.1	57.0	44.1	39.8	45.7	50.5	50.2	48.1
2	45.9	53.3	40.3	38.6	53.8	51.2	52.6	47.9
5	39.7	49.7	40.0	39.6	47.0	52.2	55.7	46.3
3	37.8	46.6	38.2	37.9	44.3	48.1	49.5	43.2
6	34.4	47.1	36.4	36.9	42.5	50.2	55.3	43.2
				On basis of weight				
1	68.9	74.9	63.8	59.6	63.2	70.0	70.1	67.2
4	69.4	77.1	67.3	61.1	66.3	72.4	71.8	69.3
2	67.3	74.5	64.2	60.8	64.7	74.2	73.4	68.4
5	61.7	72.4	63.6	61.6	67.4	74.7	76.3	68.2
3	60.3	69.7	62.3	60.1	66.7	70.6	71.6	65.9
6	55.8	68.7	58.9	57.7	62.1	72.2	76.0	64.5

the first year were distinctly inferior to the plots which were not cut until the third year. Of the plots which were cut the first year, the ones which were cut most lightly yielded substantially more during the eleven-year period than those which were cut more heavily the first year. Furthermore, plots which were given a light initial cutting the second year (Treatment 4) gave a substantially greater total yield for the eleven-year period than any of the other plots. These same relations held whether the comparison was on the basis of number of shoots or total weight of shoots (Table 10).

(For general conclusions see page 172)

TABLE 10.—TOTAL YIELDS OF ALL SIZES OF ASPARAGUS SHOOTS DURING ELEVEN-YEAR PERIOD, 1927-1937
(Averages of three replications of each cutting treatment, 1/29 acre)

Treatment No.	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Total
						Number of shoots						
1	...	...	383	936	1 508	2 172	2 290	3 198	2 616	3 516	3 477	20 096
4	...	212	439	1 310	1 510	2 186	2 393	3 292	2 693	3 557	3 560	21 149
2	...	479	562	1 108	1 314	1 899	2 012	2 887	2 345	3 089	3 086	18 781
5	91	552	991	1 147	1 371	1 936	2 035	2 787	2 348	3 054	3 084	19 396
3	249	667	733	960	1 146	1 642	1 764	2 421	1 985	2 634	2 640	16 841
6	355	786	712	811	1 027	1 424	1 626	2 330	1 998	2 586	2 679	16 334
						Weight (pounds)						
1	...	...	10.6	50.0	97.3	158.5	151.5	229.2	210.0	220.6	215.8	1 343.6
4	...	5.9	14.4	72.6	98.8	170.5	169.4	249.3	228.0	231.3	214.8	1 455.0
2	...	12.3	15.5	55.8	80.5	135.8	134.3	212.8	189.7	195.5	186.5	1 218.7
5	2.1	14.1	27.0	48.8	73.9	132.3	133.1	211.2	199.0	201.6	202.3	1 245.4
3	5.7	14.8	20.3	41.9	61.6	108.0	110.8	175.2	160.7	163.9	155.5	1 018.4
6	7.4	16.3	18.4	32.0	52.3	92.7	101.0	164.5	156.8	162.5	170.8	974.7

FROM the experiments reported herein the following conclusions can be drawn:

1. Severe cutting of a young asparagus plantation results in reduced yields and inferior market quality of shoots in subsequent years.

2. Cutting the asparagus bed during the first year after setting, even for only two weeks, is not justified.

3. Light cutting of an asparagus plantation the second year after setting seems to improve production.

4. Deferring all cutting until the third year after setting is a safe procedure, but may result in smaller total yields than light cutting the second year followed by moderate cutting the third year.

5. Good management of a young asparagus plantation that is located on soil of fairly high fertility would seem to call for the deferring of all harvesting until the second year after planting, and for limiting cutting to a period of two weeks that year and a period of four weeks the following year.

6. Cutting for eight weeks each year after the fourth year gave good results on this plantation. Apparently this is a satisfactory length of cutting season for a mature asparagus plantation.

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